Five-year Plan
(FY04 – FY08)

For The
Manufacturing Technology
(ManTech) Program

(Supplement to the FY03 – FY07 Plan)

July 2003

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I. Introduction

Section 2521(e), of Title 10, United States Code, requires that the Secretary of Defense prepare a five-year plan for the Manufacturing Technology (ManTech) Program. This requirement was amended by Public Law 107-314, Section 213, the Bob Stump National Defense Authorization Act for Fiscal Year 2003, enacted December 2, 2002. The amendments:

- reduced the requirement for update and submission of the five-year plan from annually to biennially;
- deleted the requirement to include an assessment of program effectiveness;
- deleted an assessment of the extent to which the costs of manufacturing technology projects are being shared; and
- deleted the requirement for plans for implementation of the advanced manufacturing technologies and processes being developed under the Program.

The complete text of Section 2521, as amended, is presented in Appendix A.

This, the sixth *Five-year Plan For The ManTech Program* is significantly condensed from prior year plans in that it addresses only the amended Title 10 requirements. It is presented as a supplement to the FY03 – FY07 plan and provides an update of the ManTech Program's objectives, milestones, priorities, and investment strategy by the joint program, by each military department participating in the program, and by the Defense Logistics Agency (DLA).

II. Objectives and Investment Strategy

The identification, acceleration, and maturation of key technological innovations which deliver war-winning capabilities have gained a prominent role in the transformation of the Department of Defense (DoD). With transformation underway, we must have the mechanism to rapidly insert technology into weapon systems that will make our forces more agile, deployable, sustainable, lethal, and dominant anywhere in the world. Ensuring that technology is affordable and producible remains imperative to provide this capability to our warfighters.

To that end, the objectives and investment strategy of the ManTech Program remain as stated in Section I.B. and Section II of the FY03 – FY 07 plan, respectively. As DoD transformation initiatives and strategies emerge, however, the ManTech Programs within the military departments and DLA will become even more focused on accelerating technology insertion, thereby enabling evolutionary acquisition enhancements to more rapidly transition to warfighter systems. The ability to put these new technologies into rapid production is what the ManTech Program is designed to deliver.

As shown in Figure II-1, the DoD funding request for ManTech between FY04 and FY08 continues to maintain a slight increase.

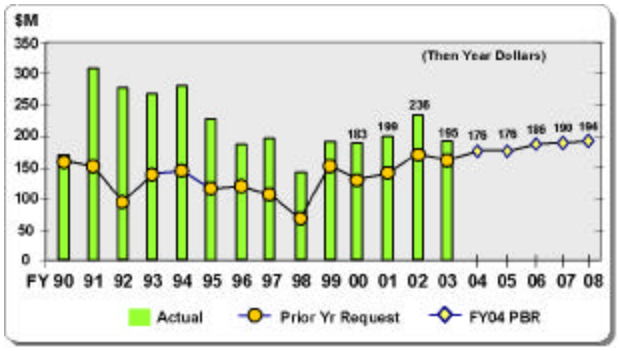

Figure II-1. ManTech Funding Trend FY90 – FY08

The DoD budget request submitted for the ManTech Program in FY04 is $176 million, an increase from the $164 million requested for FY03. The Service and DLA funds continue to be budgeted for and appropriated in four separate program elements (PEs 0708045A[1], 0708011N, 0708011F, and 0708011S). The ManTech Program's investment strategy and project prioritization process for the FY03 appropriation and the FY04 planned funding has resulted in the technical area investment distributions as shown in Table II-1 and Figure II-2.

[1]PE 0708045A, End Item Industrial Preparedness, consists of three projects, one of which is Project E25, the Army's ManTech Program. The Army funding shown throughout this document represents only that for Project E25.

		FY03	FY04	FY05	FY06	FY07	FY08
Metals	Army	17.1	4.5	2.0	8.1	8.7	8.8
	Navy	35.3	22.2	23.1	23.4	23.5	23.8
	Air Force	16.0	13.3	14.9	18.9	15.0	16.0
	DLA	13.3	6.6	4.3	4.5	4.5	4.6
	Subtotal	81.9	46.5	44.3	54.9	51.6	53.2
Composites	Army	12.4	11.7	14.2	24.8	38.3	39.8
	Navy	11.2	6.9	9.5	9.9	10.0	10.4
	Air Force	11.8	10.3	10.4	4.0	3.9	3.8
	DLA	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	35.4	29.0	34.1	38.6	52.1	53.9
Electronics	Army	27.3	49.8	51.5	44.6	33.7	34.0
	Navy	15.9	16.1	14.0	14.4	14.5	14.8
	Air Force	12.9	15.8	14.8	16.7	21.3	21.0
	DLA	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	56.0	81.7	80.4	75.7	69.4	69.9
AME	Army	0.0	0.0	0.0	0.0	0.0	0.0
	Navy	8.5	7.2	8.0	8.1	8.1	8.2
	Air Force	3.7	0.0	0.0	0.0	0.0	0.0
	DLA	7.5	9.6	6.7	6.0	6.0	6.1
	Subtotal	19.7	16.7	14.7	14.1	14.1	14.3
Energetics/ Munitions	Army	0.0	0.0	0.0	0.0	0.0	0.0
	Navy	2.2	2.3	2.3	2.3	2.3	2.2
	Air Force	0.0	0.0	0.0	0.0	0.0	0.0
	DLA	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	2.2	2.3	2.3	2.3	2.3	2.2
Total Program	Army	56.9	66.0	67.7	77.5	80.6	82.6
	Navy	73.3	54.6	56.8	58.1	58.3	59.5
	Air Force	44.4	39.4	40.1	39.5	40.2	40.8
	DLA	20.7	16.2	11.1	10.5	10.5	10.7
	Total	195.3	176.1	175.7	185.5	189.5	193.5

Table II-1. FY03 and Planned FY04 - FY08 Funding Distribution ($ million) [2]

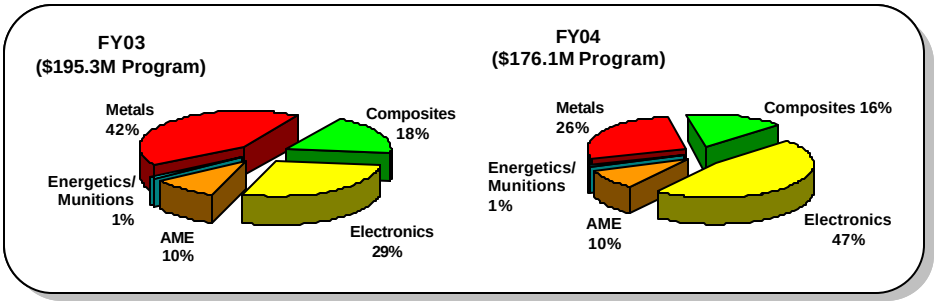

Figure II-2. FY03 Actual and FY04 Planned ManTech Investment Distributions [2]

[2] *Subtotals/totals are rounded to the nearest $0.1M.*

III. Program Content, Milestones, and Priorities

Appendix B of this plan contains updated overviews of the ManTech Program's five technical planning areas, and includes the objectives, payoffs, challenges, and milestones/metrics for each. An updated overview of the sustainment/readiness initiative is also included. More specific information on individual military department and DLA priorities are contained in their respective Research, Development, Test and Evaluation Budget Item Justification R-2 Exhibits for FY2004-2005.

The investment strategy referenced in the FY03-07 plan along with the technical area overviews, and investment summary tables shown in this supplement provide the direction and priorities of the DoD ManTech Program.

IV. Conclusion

As the DoD continues on a path of transformation, the role for ManTech is increasingly important. ManTech provides the crucial links between technology invention, development, and industrial applications. ManTech investments enable industry to develop and provide the defense-essential, affordable, low-risk manufacturing processes and practices to make possible the timely transition of technology into producible equipment for the warfighter. Early attention to manufacturing is essential for a successful transition. Moving advanced concepts from the demonstration stage into military equipment requires, among other things, the ability to affordably manufacture that equipment. To support these critical needs, ManTech's areas of emphasis for the future include:

- maintaining a focus on transition;
- expanding interaction with the technology demonstration communities by contributing manufacturing expertise to Advanced Concept Technology Demonstrations and investing in manufacturing processes and practices to support Advanced Technology Demonstrations and other Science & Technology programs intended for transition;
- continuing to identify how commercial manufacturing best practices can be adapted to defense needs;
- fostering a partnership among researchers, acquisition program managers, and military users to promote the integrated development of manufacturing processes with the development of the product; and
- promoting the inclusion of producibility as an element of Technology Readiness Assessments to reflect the state of manufacturing maturity.

The vision of the DoD ManTech program is to realize a responsive, world-class manufacturing capability to affordably meet the Warfighters' needs throughout the defense system life cycle. ManTech will continue to strive to achieve this vision, and will report its progress in the next biennial update of its five-year plan.

In the interim, additional information on the ManTech Program and its achievements will continue to be available on the DoD ManTech Web site, dodmantech.com.

The DoD ManTech Web site is provided as a public service by the Office of Technology Transition (ODUSD(AS&C)OTT) within the Office of the Deputy Under Secretary of Defense for Advanced Systems & Concepts. The Web site is produced and maintained by Andrulis Corporation, Arlington, VA.

Privacy and Security Notice

Figure IV-1. DoD ManTech Web Site

Appendix A

Section 2521, Manufacturing Technology Program, Of Title 10, USC

(As amended by P.L. 107-314, § 213, Dec 2, 2002)

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UNITED STATES CODE

TITLE 10--ARMED FORCES

Subtitle A--General Military Law

PART IV--SERVICE, SUPPLY, AND PROCUREMENT

CHAPTER 148—NATIONAL DEFENSE TECHNOLOGY AND INDUSTRIAL BASE, DEFENSE REINVESTMENT, AND DEFENSE CONVERSION

SUBCHAPTER IV--MANUFACTURING TECHNOLOGY

§ 2521. Manufacturing Technology Program

(a) ESTABLISHMENT.—The Secretary of Defense shall establish a Manufacturing Technology Program to further the national security objectives of section 2501(a) of this title through the development and application of advanced manufacturing technologies and processes that will reduce the acquisition and supportability costs of defense weapon systems and reduce manufacturing and repair cycle times across the life cycles of such systems. The Secretary shall use the joint planning process of the directors of the Department of Defense laboratories in establishing the program. The Under Secretary of Defense for Acquisition and Technology shall administer the program.

(b) PURPOSE OF PROGRAM.—The Secretary of Defense shall use the program—

(1) to provide centralized guidance and direction (including goals, milestones, and priorities) to the military departments and the Defense Agencies on all matters relating to manufacturing technology;

(2) to direct the development and implementation of Department of Defense plans, programs, projects, activities, and policies that promote the development and application of advanced technologies to manufacturing processes, tools, and equipment;

(3) to improve the manufacturing quality, productivity, technology, and practices of businesses and workers providing goods and services to the Department of Defense;

(4) to focus Department of Defense support for the development and application of advanced manufacturing technologies and processes for use to meet manufacturing requirements that are essential to the national defense, as well as for repair and remanufacturing in support of the operations of systems commands, depots, air logistics centers, and shipyards;

(5) to disseminate information concerning improved manufacturing improvement concepts, including information on such matters as best manufacturing practices, product data exchange specifications, computer-aided acquisition and logistics support, and rapid acquisition of manufactured parts;

(6) to sustain and enhance the skills and capabilities of the manufacturing work force;

(7) to promote high-performance work systems (with development and dissemination of production technologies that build upon the skills and capabilities of the work force), high levels of worker education and training; and

(8) to ensure appropriate coordination between the manufacturing technology programs and industrial preparedness programs of the Department of Defense and similar programs undertaken by other departments and agencies of the Federal Government or by the private sector.

(c) EXECUTION.—

(1) The Secretary may carry out projects under the program through the Secretaries of the military departments and the heads of the Defense Agencies.

(2) In the establishment and review of requirements for an advanced manufacturing technology or process, the Secretary shall ensure the participation of those prospective technology users that are expected to be the users of that technology or process.

(3) The Secretary shall ensure that each project under the program for the development of an advanced manufacturing technology or process includes an implementation plan for the transition of that technology or process to the prospective technology users that will be the users of that technology or process.

(4) In the periodic review of a project under the program, the Secretary shall ensure participation by those prospective technology users that are the expected users for the technology or process being developed under the project.

(5) In order to promote increased dissemination and end use of manufacturing technology throughout the national defense technology and industrial base, the Secretary shall seek, to the maximum extent practicable, the participation of manufacturers of manufacturing equipment in the projects under the program.

(6) In this subsection, the term `prospective technology users' means the following officials and elements of the Department of Defense:

(A) Program and project managers for defense weapon systems.

(B) Systems commands.

(C) Depots.

(D) Air logistics centers.

(E) Shipyards.

(d) COMPETITION AND COST SHARING.—

(1) In accordance with the policy stated in section 2374 of this title, competitive procedures shall be used for awarding all grants and entering into all contracts, cooperative agreements, and other transactions under the program.

(2) Under the competitive procedures used, the factors to be considered in the evaluation of each proposed grant, contract, cooperative agreement, or other transaction for a project under the program shall include the extent to which that proposed transaction provides for the proposed recipient to share in the cost of the project. For a project for which the Government receives an offer from only one offeror, the contracting officer shall negotiate the ratio of contract recipient cost to Government cost that represents the best value to the Government.

(e) FIVE-YEAR PLAN.—

(1) The Secretary of Defense shall prepare and maintain a five-year plan for the program.

(2) The plan shall establish the following:

(A) The overall manufacturing technology objectives, milestones, priorities, and investment strategy for the program.

(B) The specific objectives of, and funding for the program by, each military department and each Defense Agency participating in the program.

(3) The plan shall be updated biennially and shall be included in the budget justification documents submitted in support of the budget of the Department of Defense for each even-numbered fiscal year (as included in the budget of the President submitted to Congress under section 1105 of title 31).

(Added as § 2525, P.L. 103–160, § 801(a)(1), Nov. 30, 1993, 107 Stat. 1700;
revised in its entirety P.L. 103–337, § 256(a)(1), Oct. 5, 1994, 108 Stat. 2704;
P.L. 104–106, §§ 276(a), 1081(e), 1503(a)(28), Feb. 10, 1996, 110 Stat. 241, 454, 512;
P.L. 105–85, § 211(a),(b), Nov. 18, 1997, 111 Stat. 1657;
P.L. 105–261, §§ 213, 1069(a)(4),(5), Oct. 17, 1998, 112 Stat. 1947, 2136;
P.L. 106–65, § 216, Oct. 5, 1999, 113 Stat. 543;
redesignated § 2521, P.L. 106–398, § 1[344(c)(1)(A)], Oct. 30, 2000, 114 Stat. 1654, 1654A–71;
P.L. 107-314, § 213, Dec 2, 2002, 116 Stat. 2458.)

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Appendix B

Program Content by Technical Planning Area

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Metals Processing and Fabrication

Objectives:

Develop affordable, robust manufacturing processes and capabilities for evolutionary metals and special materials for rapid response to critical defense weapon system requirements. Major thrust areas that support this objective include: processing methods; special materials; joining; and inspection. Thrust area projects directly impact acquisition and sustainment lead-times as well as the cost and lifetime performance of future aircraft, rotorcraft, land combat vehicles, surface and subsurface naval platforms, space systems, artillery and ammunition, and defense industry manufacturing equipment.

Payoffs:

Benefits include affordability, reduced production cycle time, extended service life, insertion of superior special materials technology, and reduction of environmentally degrading pollutants. The metals processing methods thrust will demonstrate a 40 percent cycle time reduction, 25 percent cost reduction, and improved processing and properties of titanium, steel, and superalloys required for turbine engines and airframe components through the Metals Affordability Initiative (MAI). Laser shock peening will improve the fatigue life of rotating turbine engine components, thereby reducing lifetime maintenance requirements and extending engine life.

In the special materials thrust area, significant improvements in image quality have been realized through the production of complex optical lenses using deterministic micro-grinding and magnetorheological (MRF) finishing to reduce surface roughness in half the time of previous processes. Improved image quality directly supports improved lethality and survivability. Direct laser deposition techniques will reduce the cost of rhenium components for the Standard Missile 3 (SM3) systems by 50 percent and reduce the cycle time for many components such as the F-15 pylon rib by avoiding the long lead times for forgings.

In the joining thrust, friction stir welding (FSW) of aluminum materials is approaching implementation on the cargo deck floor of the C-130J and additional components on C-17 aircraft. The consistent properties of FSW joints improve mechanical performance of the joint over the life of the system, replacing thousands of fasteners and attendant corrosion maintenance costs. FSW has been proven a joining approach for difficult to weld alloys such as Al-Li. The joining thrust also includes efforts to utilize gas tungsten arc welding fluxes that increase weld penetration by a factor of two to four for various alloys, reducing weld time and distortion. In addition, several welding techniques are being evaluated to automatically add structural features and reduce the time of the existing manual gas metal arc welding by 50 percent; from 30 minutes to 15 minutes.

The inspection and compliance thrust includes projects are aimed at reducing labor, hazardous waste costs, and inspection times associated with hidden corrosion and cracking using improved and automated detection techniques. A major project will extend the life of turbine discs for the F100 and F110 engine families through advancements in nondestructive inspection and related depot processes to save approximately $1.3 billion and shorten the time engines are in the depot.

Challenges:

Key technical barriers include the stabilization of complex materials processes to improve yield and reduce process cycle time during phase change processes (ingot melting, casting, welding, laser additive machining (LAM)) and thermomechanical processing (rollforming, forging, friction stir welding (FSW)). A second challenge is to accelerate the technical qualification of affordability-driven materials processes for service in progressively more complex applications affecting flight and system safety. Other challenges include the development of affordable processing for the ceramic/metallic structures for the Army's future Combat Systems (FCS). One issue includes transforming the batch processing used to fabricate the ceramic armor tiles to a semi-continuous process in order to reduce the cost by 75 percent and triple the availability.

Milestones/Metrics:

FY2003:

- Transition, with a 25 percent reduction in cost and 40 percent reduction in cycle time, high yield cast turbine engine airfoils for JSF and F/A-22, LAM aero structures for the F-15 pylon ribs, FSW cargo decking for C-130J, and implementation of EB Ti onto F-15 and F/A-22.
- Demonstrate shape memory actuators to actively change blade twist on aircraft such as the Osprey to improve fuel efficiency and increase payload.
- Transition novel manufacturing and inspection process to reduce the cost of the SM3 components.

FY2004:

- Transition a cannon tube straightening technology to enable a true fleet zero calibration and improve the probability of first shot hit by 15 percent.
- Transition a novel Eddy current characterization technology to assess in-service cannon tube condition.
- Transition FSW to C-17 production and EB Ti to F-15 Tail refurbishment and F/A-22 production.
- Transition laser shock peening to extend the fatigue life of critical aerospace engine components.
- Demonstrate Ta sputtering to extend the service life of cannon tubes for applications such as the FCS.

FY2005:

- Transition a technique to affordably polish the inside surface of small tight free form optics to a finish on the order of 3 angstroms.
- Demonstrate cycle time reduction and improved lifetime performance of superalloy and titanium engine components produced by advanced rollforming via MAI.
- Transition laser shock peening to extend the fatigue life of critical aerospace engine components.
- Complete first spiral implementation of improved nondestructive inspection and related depot process to extend the life of F100 and F110 engine turbine discs for a cost avoidance of approximately $300 million.

FY2006:

- Demonstrate a 10-30 percent cost reduction of forged turbine disks produced from PM superalloys.
- Implement semi-continuous processing to reduce the cost and improve the availability of ceramic armor tiles for FCS.
- Demonstrate unitized metallic aircraft structures produced by combining advanced processes with reduced cycle time and improved affordability and reliability.
- Demonstrate physics-based improvements to machining processes and controls for steel, titanium, and superalloys.

FY2007:

- Demonstrate an improved superfine finishing for optical components to eliminate second order machine tool marks produced by traditional deterministic microgrinding techniques.
- Use laser additive manufacturing to reduce cost and cycle time for aerospace structural components such as wing carry through structures and bulkheads.
- Demonstrate super pulse laser based machining capable of drilling 50 micron size holes to improve affordability and performance in diesel engines and turbine engine blades.

FY2008:

- Develop and demonstrate novel metal and dissimilar structural material integration ,fabrication and processing enhancements for insertion on FCS, Objective Force, DD9X), CVN, and joint UCAV.

Tech Area Funding ($ in millions):

	FY03	FY04	FY05	FY06	FY07	FY08
Army	17.1	4.5	2.0	8.1	8.7	8.8
Navy	35.5	22.2	23.1	23.4	23.5	23.8
Air Force	16.0	13.3	14.9	18.9	15.0	16.0
DLA	13.3	6.6	4.3	4.5	4.5	4.6
Total	81.9	46.6	44.3	54.9	51.7	53.2

Composites Processing and Fabrication

Objectives:

Promote and implement joint Service development of affordable composite manufacturing technologies to exploit their potential for increasing weapon system effectiveness and survivability. This will be achieved through the development and maturation of rapid, affordable, robust manufacturing and assembly processes for composite structures that are transitioned to DoD systems.

Payoffs:

Composite materials and structures impact virtually every current and future DoD weapon system. They provide critical performance enhancements that enable the Department of Defense to field superior weapon systems. Composites are used in a wide spectrum of structures including aircraft, missiles, space systems, land vehicles, ships, submarines, and multiple subsystems. Composite structures have the proven capability to enhance weapon system effectiveness. These strong, lightweight structures improve range, speed, payload capability, maneuverability and signature. Composite structures are fatigue and corrosion resistant, facilitating increased durability and mission readiness.

The primary benefit will be to enable an increased capability to "Deny Enemy Sanctuary", "Protect/Sustain US Forces" and "Minimize the Logistics Footprint" at a reduced cost. This is accomplished by catalyzing a paradigm shift within the DoD and industry for the design and manufacture of composite systems through the demonstration of tools and technologies that have the potential to enable significant performance improvements as well as extensive acquisition and O&M cost avoidance for essential weapon system structures. The benefits of these initiatives will impact a wide variety of DoD systems including fighters, transports, satellites, launch vehicles, ships, submarines, missiles, ground vehicles and helicopters. Specific advancements in manufacturing technologies will provide: 1) over $1 billion cost avoidance for the JSF program; 2) a $311 million manufacturing cost avoidance for the Comanche as well as increased range and payload; 3) $26 million life cycle cost savings for the FCS through improved processes and process control; 4) a savings on JASSM of $5,200 per ship set, or $12.5 million over a production run of 2,400 units; 5) improved armor protection for Advanced Amphibious Assault Vehicle and a cost avoidance of $13.2 million; and 6) significant improvements in aircraft survivability through signature reduction for F/A-22, F-35, and UCAV. An example of protecting and sustaining US Forces resulted from a recently completed ManTech project supporting the Interceptor Body Armor. This project resulted in a $300-$500/unit reduction in fabrication costs and 40 percent weight reduction for body armor panels resulting in $193 million cost avoidance over 10 years. More importantly, the body armor is credited with saving over 29 lives so far in Afghanistan and Iraq.

Challenges:

The immaturity of high-payoff manufacturing/ assembly processes for military applications that offer substantially improved efficiency and affordability over the state-of-the-art. Rapid insertion of processes and a structural certification process to enable transition to small lot procurements, such as UCAV. Limited experience with innovative composite designs for advanced weapon systems. Advanced materials which meet fire, smoke, and toxicity requirements; overcoming material out-time problems for large, thick section processing, and affordable, robust processing of multifunctional composite structures.

Milestones/Metrics:

FY2003:

- Demonstrate subsystems integration, lightning strike management and other key performance attributes for a bonded composite wing - Unmanned Combat Air Vehicle (UCAV) configuration.
- Demonstrate a greater than $35,000 cost avoidance for low observable (LO) inlet lip and edge structures suitable for a UCAV.
- Implement improved coatings technologies for JASSM improving cycle time and achieving $6.8 million cost avoidance.

FY2004:

- Demonstrate the vacuum assisted resin transfer molding (VARTM) process in a production environment and complete development of processing guidelines.
- Complete the maturation of NDE technologies aimed to enable bonded primary structures and analysis tools for 3D loaded composite structures and joints.
- Demonstrate and validate an improved surface ship propulsion shaft coating system that will double the service life of the protection system from 6 years to 12 years and provide a cost avoidance of $24 million every 5 years.
- Demonstrate and validate $5 million cost avoidance for F414 engine exhaust flap and seal components over 520 engines. Implementation planned in 2005.
- Demonstrate and validate an improved wet filament winding process for the AIM-9X and RAM composite rocket motor cases resulting in a cost avoidance of $37.5 million.
- Demonstrate and validate a manufacturing process for non-parasitic structural armor for the AAAV troop ramp assembly resulting in a weight savings of 80 pounds and a cost avoidance of $13.2 million for the program.
- Validate the cost and performance of an integrated large area sensor structure for airborne applications.
- Demonstrate and validate an automated Z-fiber insertion process that results in a $30,000 cost reduction per F/A-18E/F.

FY2005:

- Complete validation core technologies that will establish the stability and performance of materials and processes for integrated / bonded primary structures enabling reduced acquisition and life cycle costs and reduced observability.
- Demonstrate advances in VARTM and high production rate resin transfer molding to reduce the cost of high rate F-35 composite structures.
- Validate joint behavior analysis and durability and damage tolerance methodologies for bonded composite joints.

FY2006

- Demonstrate a 85 percent fastener count reduction, a 50 percent part reduction with an attendant 35 pound weight reduction for the MH-60M tail cone.
- Demonstrate a 25 percent labor hour reduction and 30 percent weight reduction in a metal matrix composite (MMC) munition primary structure.
- Demonstrate an 80 percent fastener count reduction, a 50 percent part reduction with an attendant 22.5 pound weight reduction for the MH-60M vertical pylon.
- Implement low cost LO leading edge structures and technology supporting F-35 rate production and resulting in a $48 million cost avoidance.

FY2007

- Demonstrate a 40 percent labor hour reduction and 40 percent weight reduction in a MMC munition primary structure.
- Demonstrate a 41 pound weight reduction for the RAH-66 and a 14 percent weight reduction for MH-60M due to the development of composite housings for the main transmission and intermediate gearbox, respectively. Implementation into flight test programs is planned for 1st Quarter of FY07

FY2008

- Demonstrate increased affordability for composite metallic structures
- Demonstrate improvements in sustainment technologies for composite structures

Tech Area Funding ($ in millions):

	FY03	FY04	FY05	FY06	FY07	FY08
Army	12.4	11.7	14.2	24.8	38.3	39.8
Navy	11.2	6.9	9.5	9.9	10.0	10.4
Air Force	11.8	10.3	10.4	4.0	3.9	3.8
DLA	0.0	0.0	0.0	0.0	0.0	0.0
Total	35.4	28.9	34.1	38.7	52.2	54.0

Electronics Processing and Fabrication

Objectives:

Develop and deploy affordable, robust manufacturing processes and capabilities for electronics critical to defense applications over their full life cycle. Electronics processing and fabrication (EP&F) projects create new and improved manufacturing processes and procedures for new system production, as well for repair and maintenance of fielded systems in depots and logistics centers, with a strong emphasis on process maturation and rapid transition of new technologies into warfighting capability.

Payoffs

The direct payoffs of EP&F initiatives to the warfighter come in the form of decreased acquisition and repair cost as well as increased mission reliability and capability. The development of new electronics technology is no longer led by the military sector and the ever-shrinking product cycle in commercial electronics has created the situation where military products often contain electronics that are obsolete before they are even fielded. The integration of commercial and military and manufacturing processes into military electronic product development will demonstrate cycle time reduction by up to 50 percent and reduce the impact of component obsolescence. Consequently, the warfighter gains improved weapon system reliability and access to leading-edge electronic technologies to meet changing missions and threats. ManTech's role in developing leading edge manufacturing technologies will also have a significant impact on transformational systems such as the FCS.

EP&F initiatives are developing advanced management and predictive tools for managing obsolescence issues to sharply reduce repair cost and significantly extend the useful life of fielded weapon systems. Early work in this area has shown a potential to reduce maintenance costs by 80 percent for the ARC-210 UHF radio used in weapon systems such as the B-52, F/A-18 and RAH-66. Joint Service EP&F initiatives will also address developing and improving manufacturing processes for military unique products, such as traveling wave tubes, which have little or no commercial interest. A major initiative is underway to accelerate the fielding of next-generation electronically scanned radars by addressing producibility and affordability of aircraft applications as well as space-based radar. Another initiative is developing improved manufacturing processes for military critical microelectromechanical (MEMS) guidance and navigation systems that will reduce subsystem cost by up to 90 percent for front-line missile and munitions systems across all Services.

Challenges

The commercial electronics industry is leading development in many areas of electronics. A key challenge is to adopt and improve upon commercial models and processes for use in the production of affordable, advanced military systems. Availability, reliability, and management of obsolescence issues related to high performance military-unique devices is of concern.

The transformation of the military will result in even more dependence on state-of-the-art electronic devices, especially in the power management, infrared sensing, and high frequency areas. Wide band gap materials require much attention to material and wafer processing to become affordable and reliable. High level integration with multiple materials is needed for two-color infrared sensing. High frequency applications for MEMS switches needs attention in device construction and packaging areas.

Milestones/Metrics

FY2003:

- Implement, in an integrated circuit manufacturing line, an affordable process to apply a wafer-level, near-hermetic protective coating to commercial-off-the-shelf plastic encapsulated microcircuits that improves long-term component reliability while increasing packaging yields for initial application in missile and rotary-wing systems such as the Army Tactical Missile System (ATACMS), Theater High Altitude Area Defense (THAAD), and Comanche.
- Complete the affordable diode array manufacturing and fiber optic electrical splice initiatives for naval applications.
- Continue development of efficient and cost-effective manufacturing methods for high performance, high reliability electronics for advanced tactical missiles and aircraft missile sensors.

- Complete rapid response productivity improvement efforts to increase production (surge) rate of inertial measurement units (IMUs) for precision-guided munitions.
- Initiate a dual-band focal plane array manufacturing technology initiative to improve yield and reduce cost of 3rd generation sensors.
- Address key producibility and affordability challenges of next-generation electronically scanned array radar systems for aircraft applications and space-based radar.

FY2004:

- Demonstrate a physics of failure methodology for cycle time reduction and failure prevention for electronic components for fielded systems, and implement a life cycle cost prediction model.
- Implement improved and commercially validated and available electronic parts reliability tools for predicting life of commercial parts in military systems and insert electronic parts obsolescence management tools into weapon system production programs.
- Field commercial off-the-shelf design and production practices on the ATACMS missile program.
- Initiate new efforts in wide band gap materials that support ship platforms and efforts that support the FCS to include silicon carbide switches and very high power density lithium ion batteries for hybrid power, high energy density capacitors for electro-magnetic armor, flexible displays, software defined radios, and electronic scanning antenna phase array technologies.
- Continue program to provide a lower drift-rate IMU for MEMS.
- Complete laser component manufacturability efforts for the Affordable Missile Warning Sensor.
- Demonstrate improvements for dual-band focal plane array manufacturing to include material growth yield from 4 percent to 15 percent and detector fabrication wafer size from 25 to 35 square centimeters.
- Initiate efforts supporting producibility/affordability improvements in high priority precision-guided munitions components.

FY2005:

- Demonstrate fabrication of low cost, high precision navigational grade MEMS-based IMUs for use in systems such as the Joint Standoff Weapon (JSOW) and Low Cost Precision Kill Guided Rocket
- Demonstrate a yield improvement of 6X for 2-color infrared focal plane arrays.
- Demonstrate low-cost, reliable liquid crystal displays for rotary-wing applications.
- Initiate manufacturing process improvement work for the EA-18G.
- Demonstrate advanced manufacturing processes for F/A-22 electronically steerable array radar

FY2006:

- Demonstrate low cost flip chip process technologies for millimeter-wave gallium arsenide devices. The developments will reduce cost by at least 15 percent while improving package reliability.
- Demonstrate production processes for large format and small pixel 2-color infrared focal plane arrays.

FY2007:

- Demonstrate lower cost, higher yield manufacturing processes for laser diode arrays in support of systems such as Future Combat Systems (FCS), Objective Force, Apache, and Kiowa Warrior.
- Demonstrate low cost modules for guided missile counter-measures.
- Demonstrate RF MEMS-based phase shifters with a life greater than 10^{11} cycles.
- Demonstrate advanced manufacturing processes for space-based radar.

FY2008:

- Demonstrate advanced manufacturing process programs for electro-optics, power storage, and electronically scanned array radar in support of FCS, the Objective Force, and aviation/ship systems.

Tech Area Funding ($ in millions)

	FY03	FY04	FY05	FY06	FY07	FY08
Army	27.3	49.8	51.5	44.6	33.7	34.0
Navy	15.9	16.1	14.0	14.4	14.5	14.8
Air Force	12.9	15.8	14.8	16.7	21.3	21.0
DLA	0.0	0.0	0.0	0.0	0.0	0.0
Total	56.1	81.7	80.3	75.7	69.5	69.8

Advanced Manufacturing Enterprise

Objectives:

Subpanel activities champion accelerated defense industrial enterprise advancement towards full integration with world-class engineering systems and industrial practices. Key emphasis areas include: 1) benchmarking and/or accelerating the implementation of advanced industrial practices involved in the development, production and repair of defense weapon systems; 2) demonstrating and validating advanced business practices and information technologies that are capable of streamlining supply management functions in all defense industrial base tiers; and 3) leveraging relevant information technologies in pursuit of tighter coupling among and enhancement to enterprise functions.

Payoffs:

The opportunity to achieve dramatic cost and cycle time reductions, involving defense development, production, and repair activities, through the accelerated implementation of advanced industrial practices represents an assured force multiplier investment. Planned implementations shall establish more effective industrial and manufacturing engineering processes for planning, scheduling and controlling factory operations. These processes are directly responsible for more than one-third of weapon system costs, and strongly influence the efficiency of another third of incurred costs. The Joint Strike Fighter Program Office has determined that above-the-floor functional improvements could enable a 25-percent reduction in their forecasted production costs. Targeted commercial industry advancements have reduced unit cost by more than 50 percent, inventory by 90 percent and cycle time by 45 percent, enabling cost reductions of up to 50 percent for the selected demonstration articles. Suppliers, especially small businesses, generate the majority of manufacturing value-added in weapon systems (80 percent or more in some systems), and are the most responsible for expanded lead times involving new systems and fielded system replacement items.

Planned activities include demonstrating the capability to reduce supplier lead times and costs by 20 percent and acquisition lead times for manufactured parts by 90 percent. Industrial technology advancements, extended or applied through planned subpanel investments, are required to integrate and improve the many disparate information systems used by individual organizations and their supply chains to analyze designs for manufacturability and to plan, schedule and control manufacturing and repair facilities. Additional initiatives shall establish functional capabilities for performing comprehensive affordability analyses to facilitate design for low-cost manufacturing and rapid transition from design to production.

Challenges:

Defense industry cultural isolation has insulated the affiliated enterprise from having to accommodate competitive change, exaggerating the risks and difficulties of implementing efficient approaches to product development and production achieving dramatic success in other industries. Resulting barriers include: 1) inability to capture and communicate design intent; 2) parochial design processes that affect downstream manufacturing costs; 3) isolated manufacturing, product and cost information systems within and among companies; 4) outdated scheduling tools that lack the inherent attributes capable of achieving dramatic reductions in span time and in stock levels; 5) ineffective manufacturing planning methods capable of automatically and correctly selecting and sequencing lowest cost processes; and 6) business process rigidity that impedes rapid accommodation of unpredictable manufacturing variables.

Milestones/Metrics:

FY 2003:

- Demonstrate reductions in: 1) cycle time up to 75 percent; 2) supplier lead time up to 50 percent; 3) inventory levels up to 75 percent; and 4) life cycle cost up to 10 percent via the application of lean enterprise principles involving two or more weapon systems.

FY 2004:

- Establish a seamless interface between the warfighter and the military apparel supply base.

FY 2005:

- Demonstrate and introduce advanced modeling and simulation capabilities, targeting: 1) processes and practices implementation; 2) work flow constraints identification; 3) waste elimination; and/or 4) cycle time reduction, in support of controlling and/or optimizing factory floor operations.

FY 2006:

- Implement affordable advanced manufacturing and business processes that reduce the cost and risk of developing, producing and supporting military space systems throughout the systems life cycle.

FY 2007:

- Demonstrate capability for performing comprehensive affordability analyses to facilitate design for low-cost manufacturing and rapid transition from design to production.

FY 2008:

- Develop and demonstrate rapid transition supplier initiatives for key evolutionary acquisition objectives for apparel, combat rations, and shipbuilding.

Tech Area Funding ($ in millions):

	FY03	FY04	FY05	FY06	FY07	FY08
Army	0.0	0.0	0.0	0.0	0.0	0.0
Navy	8.5	7.2	8.0	8.1	8.1	8.2
Air Force	3.7	0.0	0.0	0.0	0.0	0.0
DLA	7.5	9.6	6.7	6.0	6.0	6.1
Total	19.7	16.8	14.7	14.1	14.1	14.3

Energetics and Munitions

Objectives:

The munitions, propellants and explosives used by the DoD are defense-unique and are essential to its warfighting capabilities. Programs focus on manufacturing technology for the synthesis of new or improved energetic materials, improved processes for manufacturing propellants and explosives, as well as processes to handle and load energetic materials into weapon system components and munitions. In addition, this topic area also focuses on the manufacturing processes necessary to enable safe, cost effective manufacture of munitions and munitions components. Every weapon system depends on these materials to achieve its mission.

Payoffs:

The payoff to all three services will be more affordable munitions, missiles, and energetic systems. The investment will permit transition of advanced materials and technologies that will improve performance while reducing life cycle cost, extending service life, and reducing the impact to the environment. Manufacturing technology investment in the manufacturing processes for the energetic materials such as Hexanitro-hexaazaisowurtzitane (CL-20) and Triamino-trinitrobenzene (TATB) will result in more consistent performance and safety properties, and drive the cost of producing these promising new materials down by 30 percent to 50 percent. Development of production-oriented packaging techniques for miniature explosive train components contained in the Safety and Arming (S&A) Device of the Canistered Countermeasure Set, Anti-Torpedo (CCAT) will significantly reduce labor requirements and therefore the cost of manufacture. Development of affordable co-layering processing techniques for manufacture of layered gun propellants will provide gun systems greater range and lethality for surface ship weapons.

Challenges:

Development and fielding of new energetic materials and munitions manufacturing processes is slow and deliberate due to the obvious concerns for safety that must be the primary focus of any activity involving these materials. Transition of new processes into manufacturing is also a very deliberate process that is hindered by the need for the industry to make capital investments often without a clear payback due to changing DoD budgets and acquisition requirements. Lack of Army investment in this critical area will have a detrimental impact upon transformation of the munitions industrial base and its ability to provide next generation energetics and munitions in support of systems such as the Army's Future Combat System.

Milestones/Metrics

FY2003:

- Conduct a technical exchange workshop on CL-20 technology and applications.
- Develop final process improvements, fabricate and test miniaturized safe and arm components for the CCAT warhead.

FY2004:

- Demonstrate and qualify agile manufacturing of TATB.
- Demonstrate affordable manufacture of miniaturized safe and arm components for the CCAT warhead.

FY2005:

- Demonstrate affordable manufacture of high performance layered gun propellants.

FY2006 – FY 2008:

- Develop selected manufacturing technologies to satisfy operational objectives for next generation energetic materials.

Tech Area Funding ($ in millions)

	FY03	FY04	FY05	FY06	FY07	FY08
Army	0.0	0.0	0.0	0.0	0.0	0.0
Navy	2.2	2.3	2.3	2.3	2.3	2.2
Air Force	0.0	0.0	0.0	0.0	0.0	0.0
DLA	0.0	0.0	0.0	0.0	0.0	0.0
Total	2.2	2.3	2.3	2.3	2.3	2.2

Sustainment

Objectives:

Demonstrate and establish enabling maintenance, repair and overhaul (MRO) technologies and business practice advancements to affordably facilitate using current weapon systems far beyond their intended design life. Primary emphasis areas include enterprise transformation, process modernization, and repair cycle enhancement that can lead to a beneficial shift in weapon system sustainment affordability.

Payoffs:

Logistics support comprises 60 percent of the total life cycle costs for most weapon systems. The DoD spends approximately $80 billion annually on logistics support, allocating $13 billion of this amount towards depot maintenance (organic and contract). Weapon system modernization remains impeded due to declining DoD budgets and the increase cost to maintain aging systems (technical data availability, parts obsolescence, structural fatigue, corrosion, etc.). The introduction of "*Lean*" practices and associated business process reengineering efforts offer the potential to significantly reduce repair cycle time (25 percent to 40 percent) and product development costs for modifications and upgrades (20 percent to 30 percent). These cycle time reductions can speed the introduction of new technology in our fielded systems and sharply decrease the amount of time these high-value systems are down for repair or in the depot. The introduction of improved MRO processes in the private and public sectors offer potential for near- and long-term weapon system cost avoidance approaching 10 percent to 25 percent.

Challenges:

Primary challenges include: 1) demonstrating process modernization advancements aimed at improving MRO cycle time and associated product quality and/or reliability; 2) implementing high payoff sustainment enterprise transformation initiatives capable of reducing weapon system life cycle costs and enhancing readiness; 3) improving high-value system/component reliability and/or availability through continuous process improvement; and 4) enabling extended weapon system/subsystem longevity without compromising safety, readiness or affordability.

Milestones/Metrics:

FY2003:

- Achieve 20 percent reduction in supplier cost for critical aircraft, helicopter and ground vehicle components.
- Reduce modification and/or upgrade product development time and overall costs involving selected Air Force aircraft, Army Kiowa helicopters, Navy CVN ships and/or Marine LAVs.
- Demonstrate major reductions ($\geq$ 50 percent) in repair cycle times involving selected critical aircraft, engine, electronics, ground vehicle and helicopter system components.

FY2004:

- Achieve 25 percent reduction in sustainment costs involving selected aircraft mission electronic components.
- Shift the sustainment industrial base towards "world class practices" (waste and inefficiencies elimination), achieving a 50 percent cost avoidance involving selected system workloads.

FY2005:

- Establish initial production implementation of advanced nondestructive evaluation and repair process technologies, increasing useful component life by 50 percent for selected critical components in the F100 and the F110 engine families and enabling a cost avoidance in excess of $300 million.
- Achieve 40 percent improvement in established mean-time-between failure (MTBF) rates for selected electronic systems/components involving frontline Air Force weapons systems.

FY2006:

- Continue to establish and to deploy enabling business process transformation enablers, focused on helping to facilitate a $2.75 billion cumulative Air Force depot maintenance cost avoidance through FY07.

FY2007:

- Champion forging technologies advancement, helping to minimize the incurred expense associated with replacing primary aging aircraft structural components that are being retained in service beyond their original design life. The activity supports all three Services and diverse platform requirements.

FY2008:

- Continue to advance metal casting technologies, enabling depot sustainment activities to affordably shift from relying on machined metal parts for replacement parts purposes. Achieved advancements will help minimize incurred challenges associated with casting complex geometries.

Tech Area Funding ($ in millions):

All ManTech sustainment-related projects are under the purview of an assigned JDMTP oversight activity [Metals, Composites, Electronics, Advanced Manufacturing Enterprise (AME), or Energetics/Munitions Subpanel] for bookkeeping and program/portfolio review purposes.

The following funding table is a sustainment/readiness crosscut assessment of Metals, Composites, Electronics, AME, and Energetics/Munitions Subpanel project funding. ***The purpose of this funding table is to highlight the ManTech Program investment addressing sustainment/readiness requirements. For example, the Army program supporting aviation composite structures will benefit legacy systems such as the MH-60, but which will also impact future systems that are part of the Army's Objective Force. The dollars shown below <u>should not</u> be added to the subpanel roadmap funding totals because this action would result in double accounting.***

	FY03	FY04	FY05	FY06	FY07	FY08
Army	15.2	4.1	2.7	1.1	0.3	0.0
Navy	7.3	7.2	4.7	4.5	4.2	4.2
Air Force	12.3	8.4	9.7	6.0	6.3	6.5
DLA	11.5	5.4	5.1	4.5	4.5	4.6
Total	46.4	25.1	22.3	16.1	15.2	15.3